REMARKS

Statement of Substance of Interview

Applicants appreciate the courtesy of a telephone interview between Examiners Pathak and Nguyen and the undersigned on April 5, 2010. Claim 1 was discussed with regard to the art rejections. In particular, Applicants explained that Shuji teaches away from modification with Araghi and that, from a technical standpoint, the cited references are not suitable for modification as suggested (as further discussed herein).

The Examiner agreed that Shuji disparages splitting the subject wafer obliquely, but asserted that Shuji does so only for the case in which the first and second grooves are aligned. The Examiner stated that Araghi teaches the advantage of oblique division where grooves are not aligned. Furthermore, the Examiner stated that a skilled artisan would have modified the references as suggested even though Shuji teaches a sapphire substrate and Araghi teaches a silicon substrate because a skilled artisan would have taken such differences into account with respect to cleavability of any particular substrate.

No agreement was reached.

It is respectfully submitted that the present Statement of Substance of Interview complies with the requirements of 37 C.F.R. §§ 1.2 and 1.133 and MPEP § 713.04.

Response to Rejection under 35 U.S.C. § 103

A. Claims 1, 3-7, 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 10125958 to Shuji et al. ("Shuji") in view of U.S. Patent 4,604,161 to Araghi ("Araghi").

The Examiner maintained the rejection essentially for the reasons of record. Namely, regarding claim 1, Shuji was cited as teaching a method for the production of gallium nitride compound semiconductor chips from a wafer having gallium nitride compound semiconductor

layers laminated on a principal surface of a substrate formed of hexagonal crystal, comprising: a step of linearly forming first grooves in a desired chip shape by etching on a side of the gallium nitride compound semiconductor layers of said wafer ([0007], lines 1-6; Drawing 3, elements 11, 2, 3); a step of forming second grooves having a line width (W2) equal to or smaller than a line width (W1) of the first grooves on a side of the substrate of said wafer ([0007], lines 9-10; Drawing 3, elements W1, 11, W2, 22); and a step of dividing said wafer along said first and second grooves into pieces each of a chip shape ([0007], lines 11-12; [0010], lines 12-14; [0021], lines 9-10). The Examiner asserted that the wafers are separated along the "Chuo Line".

The Examiner recognized that Shuji does not teach the feature of "wherein said positions at which the second grooves are formed are decided by performing a trial division in advance." The Examiner took the position, however, that a skilled artisan would have optimized the position of the second groove for subsequent duplication.

The Examiner also recognized that Shuji does not teach a step of forming second grooves having a line width (W2) equal to or smaller than a line width (W1) of the first grooves on a side of the substrate of said wafer at positions *not conforming* to the central lines of the first grooves.

Araghi is cited as teaching a step of forming second grooves...of said wafer at positions not conforming to the central lines of the first grooves (column 3, lines 50-56; Fig. 3, elements 35, 37, 40, 44, 45).

The reason for combining the teachings of Araghi with Shuji as asserted by the Examiner is to provide chips having precisely controlled ends and line edges for butting against the ends of like arrays.

Regarding claims 3-5, the Examiner recognized that Shuji in view of Araghi does not teach the claimed features but asserted that the features would have been obvious to a skilled

artisan because "[w]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation" (citing *In re Aller*).

Regarding claim 6, Shuji is cited as teaching wherein said first grooves are confronted by an electrode-forming surface for forming an electrode for gallium nitride compound semiconductor chips (citing [0016] and Fig. 4).

The rejection should be withdrawn for the following reasons.

(1) Shuji teaches away from modification with Araghi. Namely, Shuji discredits slanting fracture lines (*e.g.*, line c) and even prescribes width W1 to accommodate for such a slanting fracture line (*e.g.*, line b) as shown in Fig. 1. Shuji describes that, as shown by a broken line "a" in Fig. 1, the wafer is most preferably divided into pieces each of a chip shape along positions where the center lines of the first grooves conform to the center lines of the second grooves (paragraph 0010). Shuji also describes that it is not desirable for the wafer to be broken obliquely as shown by a broken line "c" in Fig. 1 (paragraph 0010).

Further, a skilled artisan would not have contravened the express teaching of Shuji in order to control a slanting fracture line. Shuji expressly teaches a "process which separates a wafer in the shape of a chip along the first rate slot and the second rate slot" ([0007])—that is, along the vertical center line. Shuji discloses a method of polishing to thin a substrate (paragraph 0010), a method of forming the second groove to be deep (Fig. 2 and paragraph 0011), and a method of forming the first groove to be deep (Fig. 3 and paragraph 0014) in order to split off the wafer vertically.

As described above, Shuji disparages splitting the wafer obliquely. Accordingly, Shuji teaches away from making the modification suggested by the Examiner (relying on Araghi at

column 3, lines 50-56 and Fig. 3, *i.e.*, the modification that the centerline (45) of the inside groove (40) is deliberately offset from the centerline (44) of the etched end groove (35)).

The Examiner recognized that the fracture line of Shuji is intended to be vertical. It is for this reason (that Shuji teaches that a slanted fracture line is not intended) that Shuji teaches away from a combination with the slanted center line of Araghi as suggested by the Examiner.

(2) A skilled artisan would not (and could not) have applied the cutting method of Araghi to the substrate of Shuji from a technical perspective.

As shown by the translation previously provided in Amendment of October 26, 2009, Shuji teaches that, in cutting the sapphire substrate, the wafer is divided along the line "a", "b", or "c" illustrated in Fig. 1, and thereby it is impossible to control the angle of oblique division. This is because the wafer of Shuji is a nitride semiconductor laminated on a sapphire substrate and does not possess cleavability (paragraph [0005]). Shuji describes in the latter half of paragraph [0010]:

> *"As shown by a broken line 'a' in Fig. 1, the wafer is most preferably divided into pieces each of a chip shape at positions where the center lines of the first grooves conform to the center lines of the second grooves. However, if the wafer is too thick, the wafer is likely to be divided obliquely as shown by a broken line "c" in Fig. 1, and even the p-n junction interface is cut off, resulting in chip pieces having undesired shapes." (Applicants' translation)*

Shuji teaches that the sapphire substrate does not have cleavability because of the characteristic hexagonal system of the crystal structure of single crystal sapphire of the substrate of Shuji (paragraph [0005]). Shuji teaches that the wafer, in which a nitride semiconductor is laminated on the sapphire substrate, splits obliquely as shown by a broken line "c" in Fig. 1 and,

as a result, tends to be divided into chip pieces having unintended shapes (paragraph 0010). Specifically, the broken lines "b" and "c" illustrated in Fig. 1 are not straight lines but bend along the way. In other words, according to Shuji, the sapphire substrate does not have cleavability and therefore it is impossible to control the angle of division.

As used here, the term "cleavage" denotes that a mineral crystal is easily split in a given direction to thereby form smooth surfaces, *i.e.*, cleavage plane. Some mineral substances are significantly cleavable, some are less cleavable, and others are not cleavable at all. In this regard, Applicants refer to "Rikagaku Jiten (Dictionary of Science and Chemistry)", 5th Edition, published by Iwanami Shoten Publishers (copy attached).

From a technical perspective, silicon tends to be cleaved extremely easily along the (111) plane, and a silicon substrate having a (100) plane is linearly cleaved precisely at an angle of 54.7° to thereby form a smooth (111) plane. As such, the cutting method of Araghi relies on the particular cleavability of the silicon wafer at an angle of 54.7 degrees.

This property of the cleavability of silicon is known in the art. For example, U.S. Patent 7,067,427 to Tsuchiya et al. states teaches that a "Si substrate on which a Cu film was grown was cleaved into a size of 1.2x1.2 cm^2" (column 11, lines 30-31). That is, when a substrate to be used has cleavability, those in the relevant art generally cut the substrate utilizing the cleavability of the substrate.

On the other hand, a sapphire substrate does not have cleavability and therefore it is impossible to cut a sapphire substrate by utilizing the feature of cleavability, which the sapphire substrate does not intrinsically have.

A skilled artisan would readily appreciate the differences between the properties of a silicon substrate and those of a sapphire substrate. Accordingly, such a skilled artisan would not

have combined the disclosure of Shuji, which relies on a sapphire substrate without intrinsic cleavability, with the disclosure of Araghi, which method relies on the property of cleavability intrinsic in the silicon substrate.

More specifically, it is impossible to apply a cutting method that utilizes an intrinsic property of a silicon substrate, *e.g.*, having a (100) plane that is cleaved accurately along the smooth (111) plane, to a substrate that does not possess cleavability such as a sapphire substrate. Because of this, a skilled artisan would not (and could not) have combined the disclosure of Araghi, which utilizes accurate cleavability of a silicon substrate, with the disclosure of Shuji, in which the subject sapphire substrate has no cleavability and whose angle of division is uncontrollable.

(3) A skilled artisan would not have optimized the *teachings of the cited references* as suggested. As stated above, a skilled artisan would understand Shuji to disclose that it is impossible to control the angle at which the sapphire substrate is divided obliquely. Since Araghi discloses a silicon wafer, the chip is separated along the cleaving plane of the silicon substrate. On the other hand, because the claimed substrate, and that of Shuji, is formed of a hexagonal crystal, its cleaving plane differs from that of silicon. That is, the angle of the cut face is not a parameter subject to optimization, but rather, is a property inherent in the crystal structure of the wafer. For this reason, a skilled artisan would not have optimized the teachings of the cited references as asserted by the Examiner.

Reconsideration and withdrawal of the rejection are respectfully requested.

B. Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Shuji in view of Araghi as applied to claim 1 above, and further in view of U.S. Patent Application

Publication 2002/0014681 Al to Tsuda et al. ("Tsuda") and U.S. Patent Application Publication 2002/0105986 Al to Yamasaki et al. ("Yamasaki").

Claim 2 is patentable over Shuji in view of Araghi in further view of Tsuda and Yamasaki for at least the reasons stated above. Namely, Shuji teaches away from modification with Araghi; a skilled artisan would not (and could not) have applied the cutting method of Araghi to the substrate of Shuji from a technical perspective; and a skilled artisan would not have optimized the teachings of the cited references as suggested. Reconsideration and withdrawal of the rejection are respectfully requested.

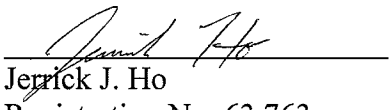
C. Claims 1, 8-10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shuji in view of Araghi as applied to claim 1 above, and further in view of U.S. Patent Application Publication 2001/0038655 Al to Tanaka et al.

Claims 1, 8-10 are patentable over Shuji in view of Araghi further in view of Tanaka for at least the reasons stated above. Namely, Shuji teaches away from modification with Araghi; a skilled artisan would not (and could not) have applied the cutting method of Araghi to the substrate of Shuji from a technical perspective; and a skilled artisan would not have optimized the teachings of the cited references as suggested. Reconsideration and withdrawal of the rejection are respectfully requested.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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